Detailed Methods

Group A and Group B received telerehabilitation (TR) via Tencent Meeting video software under real-time guidance from speech therapists, while Group C completed offline therapy in a clinical setting with speech therapists supervision. The TR groups differed only in the intensity of ORLA protocols. Speech therapists pre-assessed individual aphasia severity levels and curated personalized digital materials in advance. These materials, designed around daily life-related content (e.g., personal routines, familial interactions), were structured into a three-tiered difficulty progression:The difficulty coefficient ranged from 3-5 words for simple short sentences to 8-12 words for medium-long sentences or gradually expanded to complex sentences (15-30 words), short texts, etc.

The specific steps were as follows (ORLA):

① The therapist reads the training materials loudly and points out each word while reading;

② The therapist reads the training materials again and asks the patient to point out each word while listening;

③ The therapist randomly reads out a word or phrase in a sentence (either a real word or a function word) and asks the patient to identify and point it out;

④ The therapist randomly points out a word or phrase in the sentence (which can be a content word such as a noun or verb or a function word such as a pronoun, preposition, or conjunction) and asks the patient to read it aloud;

⑤ The therapist reads sentences aloud with the patient, mainly focusing on the patient. The therapist adjusts their speaking speed and volume based on the patient's specific ability level (for example, by slightly reading out the sound before the patient so that the patient can hear the initial phoneme of the word; as the patient needs fewer clues, the volume decreases), while reading aloud, asking the patient to recognize and point out each word and phrase;

⑥ Please ask the patient to read the complete sentence aloud, pointing out each word while reading;

⑦ Please ask the patient to read the complete sentence aloud again.

Supplemental Tables

Table S1. Subitems paired comparison 1

CCread	TIME	TIME	M.D	[95% CI]	Std.Error	df	*P Value*
	1.00	2.00	-9.26*	[-11.00, -7.52]	0.87	42.05	**0.000**
		3.00	-9.98*	[-11.72, -8.23]	0.87	44.99	**0.000**
	2.00	3.00	-0.71*	[-1.38, -0.05]	0.34	26.64	**0.037**
CWread							
	1.00	2.00	-1.13*	[-1.35, -0.91]	0.11	48.82	**0.000**
		3.00	-1.52*	[-1.75, -1.29]	0.11	53.35	**0.000**
	2.00	3.00	-0.39*	[-0.60, -0.18]	0.10	15.34	**0.001**
CWname							
	1.00	2.00	-0.93*	[-1.26, -0.60]	0.16	42.05	**0.000**
		3.00	-0.98*	[-1.32, -0.65]	0.17	44.99	**0.000**
	2.00	3.00	-0.05	[-0.25, 0.14]	0.09	26.64	0.574
CWfluen							
	1.00	2.00	-1.10*	[-1.38, -0.81]	0.14	42.93	**0.000**
		3.00	-1.36*	[-1.64, -1.08]	0.14	44.17	**0.000**
	2.00	3.00	-0.26*	[-0.41, -0.12]	0.07	35.89	**0.001**
CWdisco							
	1.00	2.00	-0.98*	[-1.25, -0.70]	0.14	45.92	**0.000**
		3.00	-1.21*	[-1.49, -0.94]	0.14	46.60	**0.000**
	2.00	3.00	-0.24*	[-0.42, -0.06]	0.09	30.04	**0.011**
CWlisten							
	1.00	2.00	-0.82*	[-1.14, -0.50]	0.16	43.13	**0.000**
		3.00	-1.00*	[-1.33, -0.66]	0.17	43.34	**0.000**
	2.00	3.00	-0.18*	[-0.34, -0.02]	0.08	35.32	**0.029**

Bold font indicates *P value* less than 0.05; * indicates the data has statistical significance; MD,Mean difference;CCread, CRRCAE-reading subitem; CWread, WAB-reading subitem; CWname, WAB-naming subitem; CWfluen, WAB-fluency subitem; CWdisco, WAB-discorse subitem; CWlisten, WAB-listening comprehension subitem.

Table S2.   Subitems paired comparison 2

CCread	GROUP	GROUP	M.D	[95% CI]	Std.Error	df	*P Value*
	C	B	24.17*	[17.14, 31.19]	3.49	46.41	**0.000**
		A	0.37	[-6.66, 7.40]	3.49	46.41	0.916
	B	A	-23.80*	[-30.82, -16.77]	3.49	46.41	**0.000**
CWread							
	C	B	2.09*	[1.50, 2.68]	0.29	25.95	**0.000**
		A	0.09	[-0.50, 0.67]	0.29	25.95	0.761
	B	A	-2.00*	[-2.59, -1.42]	0.29	25.95	**0.000**
CWname							
	C	B	1.09*	[0.28, 1.90]	0.40	38.34	**0.000**
		A	0.24	[-0.57, 1.05]	0.40	38.34	0.761
	B	A	-0.85*	[-1.66, -0.04]	0.40	38.34	**0.000**
CWfluen							
	C	B	1.21*	[0.38, 2.05]	0.42	41.58	**0.006**
		A	-0.38	[-1.22, 0.46]	0.42	41.58	0.364
	B	A	-1.60*	[-2.43, -0.76]	0.42	41.58	**0.000**
CWdisco							
	C	B	1.34*	[0.47, 2.21]	0.43	37.34	**0.004**
		A	0.03	[-0.85, 0.90]	0.43	37.34	0.954
	B	A	-1.32*	[-2.19, -0.44]	0.43	37.34	**0.004**
CWlisten							
	C	B	1.04	[-0.03, 2.10]	0.53	38.63	0.055
		A	0.32	[-0.74, 1.39]	0.53	38.63	0.541
	B	A	-0.71	[-1.78, 0.35]	0.53	38.63	0.182

Bold font indicates *P value* less than 0.05; * indicates the data has statistical significance; MD,Mean difference;CCread, CRRCAE-reading subitem; CWread, WAB-reading subitem; CWname, WAB-naming subitem; CWfluen, WAB-fluency subitem; CWdisco, WAB-discorse subitem; CWlisten, WAB-listening subitem; Group[A], moderate-to-high-intensity ORLA telerehabilitation group; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.

Table S3. CWread interaction comparison

predictors	MD in CWread	[95% CI]	Std.Error	T Value	P Value
(Intercept)	3.89	[3.43, 4.34]	0.23	17.20	**0.000**
Group[C]	0.07	[-0.57, 0.71]	0.32	0.21	0.833
Group[B]	-2.29	[-2.93, -1.64]	0.32	-7.14	**0.000**
TIME[1]	-1.72	[-2.12, -1.33]	0.20	-8.74	**0.000**
TIME[2]	-0.49	[-0.86, -0.12]	0.17	-2.82	**0.013**
Group[C]*TIME[1]	0.01	[-0.55, 0.56]	0.28	0.02	0.984
Group[C]*TIME[2]	0.05	[-0.47, 0.57]	0.25	0.22	0.830
Group[B]*TIME[1]	0.60	[0.04, 1.16]	0.28	2.16	**0.036**
Group[B]*TIME[2]	0.25	[7.84, 24.12]	0.25	1.01	0.326

* indicates interaction; Bold font indicates *P value* less than 0.05; MD,Mean difference;CWread, WAB-reading subitem; TIME[1],Pre_Post=T0_T1; TIME[2],Pre_Post=T0_T2;T1, 4 weeks post-intervention; T2, 3 months post-intervention; T3, 6 months post-intervention; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.

Table S4. CWname interaction comparison

predictors	MD in CWname	[95% CI]	Std.Error	T Value	P Value
(Intercept)	3.06	[2.47,3.64]	0.29	10.55	**0.000**
Group[C]	0.28	[-0.54,1.11]	0.41	0.69	0.492
Group[B]	-0.80	[-1.63,0.02]	0.41	-1.96	0.056
TIME[1]	-0.96	[-1.55, -0.38]	0.29	-3.32	**0.002**
TIME[2]	-0.02	[-0.32,0.35]	0.16	0.11	0.910

Bold font indicates *P value* less than 0.05; MD,Mean difference; CWname, WAB-naming subitem;TIME[1],Pre_Post=T0_T1; TIME[2],Pre_Post=T0_T2;T1, 4 weeks post-intervention; T2, 3 months post-intervention; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.

Table S5. CWfluen interaction comparison

predictors	MD in CWfluen	[95% CI]	Std.Error	T Value	P Value
(Intercept)	3.36	[2.77,3.94]	0.29	11.58	**0.000**
Group[C]	-0.36	[-1.19,0.47]	0.41	-0.87	0.389
Group[B]	-1.71	[-2.54, -0.89]	0.41	-4.18	**0.000**
TIME[1]	-1.50	[-1.99, -1.01]	0.24	-6.23	**0.000**
TIME[2]	-0.21	[-0.47,0.04]	0.13	-1.71	0.097

Bold font indicates *P value* less than 0.05; MD,Mean difference;CWfluen, WAB-fluency subitem;TIME[1],Pre_Post=T0_T1; TIME[2],Pre_Post=T0_T2;T1, 4 weeks post-intervention; T2, 3 months post-intervention; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.

Table S6. CWdisco interaction comparison

predictors	MD in CWdisco	[95% CI]	Std.Error	T Value	P Value
(Intercept)	2.64	[2.77, 3.94]	0.31	8.49	**0.000**
Group[C]	-0.07	[-1.19, 0.47]	0.44	-0.16	0.872
Group[B]	-1.43	[-2.54, -0.89]	0.44	-3.25	**0.002**
TIME[1]	-1.64	[-1.99, -1.01]	0.22	-7.30	**0.000**
TIME[2]	-0.29	[-0.47, 0.04]	0.16	-1.80	0.083
Group[C]*TIME[1]	0.57	[-0.62, 0.76]	0.32	1.80	0.079
Group[C]*TIME[2]	0.07	[-0.50, 0.22]	0.22	0.32	0.753
Group[B]*TIME[1]	0.71	[-0.33, 1.04]	0.32	2.25	**0.030**
Group[B]*TIME[2]	0.07	[-0.36, 0.36]	0.22	0.32	0.753

* indicates interaction;Bold font indicates *P value* less than 0.05; MD,Mean difference; CWdisco, WAB-discorse subitem;TIME[1],Pre_Post=T0_T1;TIME[2],Pre_Post=T0_T2; T1, 4 weeks post-intervention; T2, 3 months post-intervention; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.

Table S7. CWlisten interaction comparison

predictors	MD in CWlisten	[95% CI]	Std.Error	T Value	P Value
(Intercept)	3.03	[2.25, 3.80]	0.38	7.89	**0.000**
Group[C]	0.47	[-0.63, 1.56]	0.54	0.86	0.395
Group[B]	-0.54	[-1.64, 0.55]	0.54	-1.00	0.322
TIME[1]	-0.96	[-1.55, -0.37]	0.29	-3.28	**0.002**
TIME[2]	-0.01	[-0.29, 0.26]	0.13	-0.11	0.916

Bold font indicates *P value* less than 0.05; MD,Mean difference; CWlisten, WAB-listening Comprehension subitem;TIME[1],Pre_Post=T0_T1;TIME[2],Pre_Post=T0_T2; T1, 4 weeks post-intervention; T2, 3 months post-intervention; Group[B], low-intensity ORLA telerehabilitation group;Group[C],moderate-to-high-intensity ORLA offline group.